

# Market Mechanisms for Variable Renewable Integration

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Transmission & Distribution Challenges in the UK  
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Leaders in the design, implementation and operation of markets for electricity, gas and water.



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# Introduction – Project objectives

- 12 month research study for IEA-RETD
- Project Objectives
  - Electricity market products and services needed for better integration of variable electricity generation
    - Market systems to effectively incorporate variable sources of Renewable energy
    - Cross-border electricity trade
    - Proactive grid planning
- Transmission & distribution
  - Development, access and charging

■ GB	■ Ireland	■ France	■ Germany
■ Netherlands	■ Italy	■ Denmark	■ Sweden
■ Finland	■ Norway	■ Ontario	■ Alberta

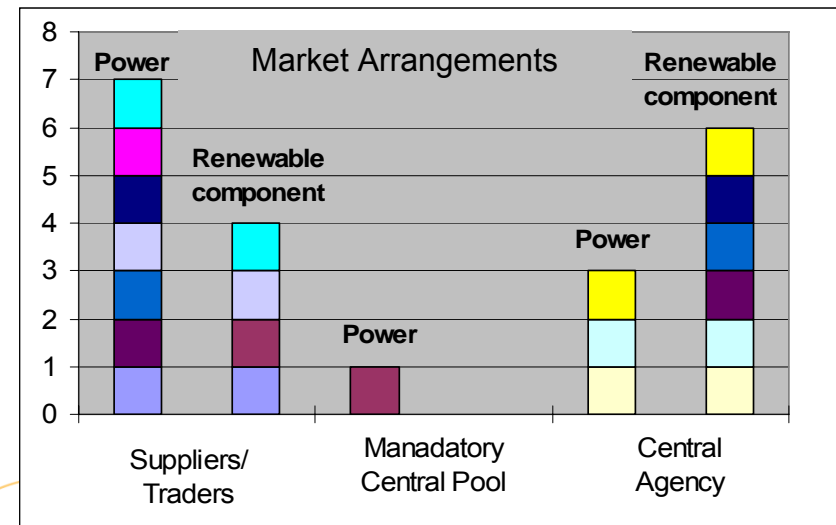
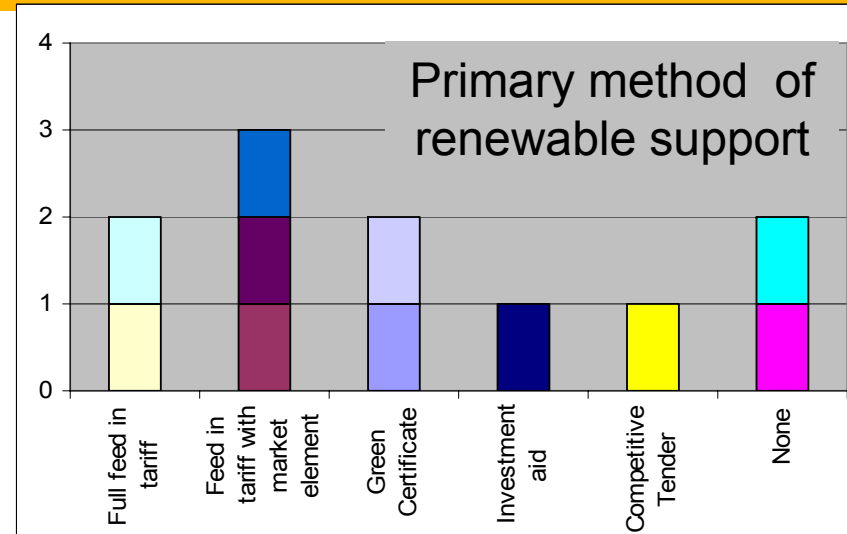
# Objectives of Integrating Renewables

- Targeted Renewable Deployment
  - EU target of 20% of energy from renewables by 2020
  - Accept special market treatment & subsidies
- OR
- Minimising Market Distortions
  - Carbon pricing policy for incentivising low carbon generation
  - Remove special market treatment & subsidies over medium term



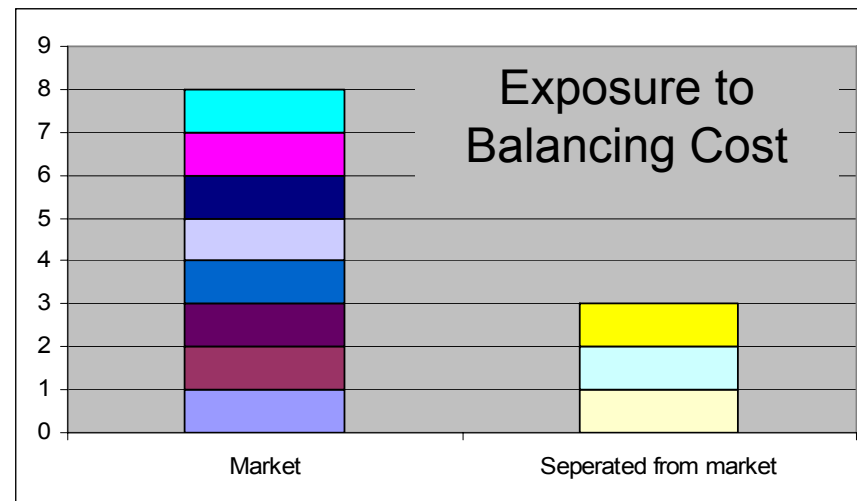
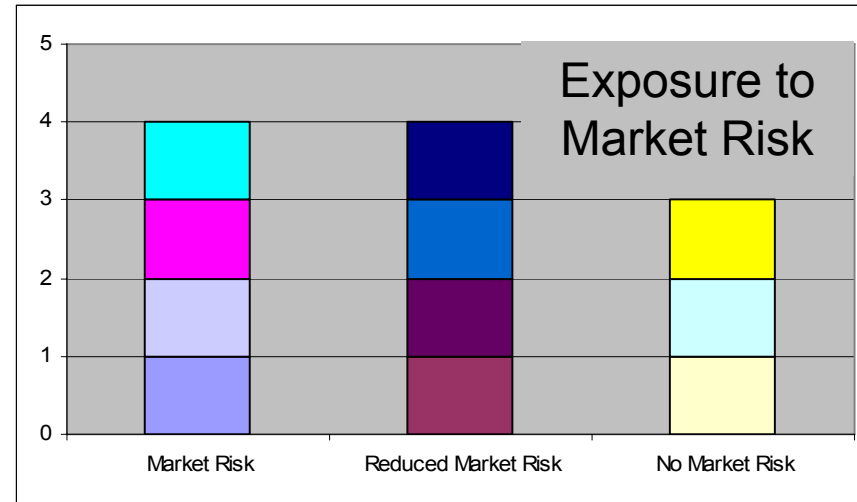
# Market Integration

- Renewable generation requires financial support
  - Most countries provide support mechanisms
- Market integration varies
  - Level & type
  - GB
    - Generators trade power & ROCs
    - Similar to conventional plant
  - Central agencies
    - Remove market risk
    - Remove balancing risk



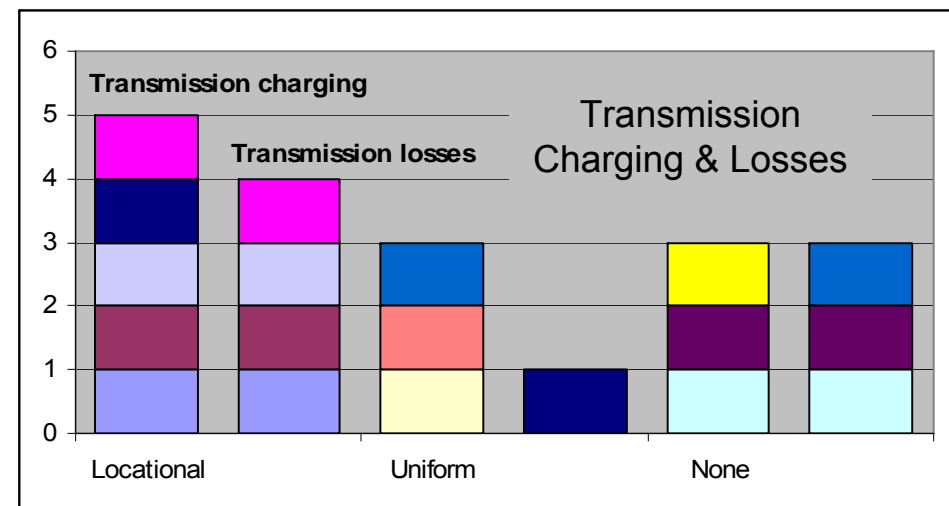
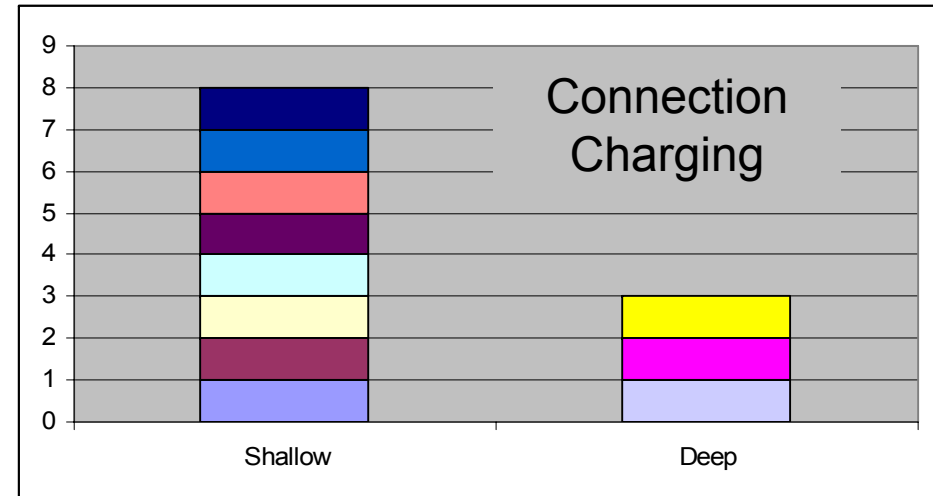
# Market Risk

- Renewables may be exposed to market risk
  - GB renewables
    - Full exposure to market risk and balancing costs
    - Traded as conventional generation
- Differences in renewables & conventional plant
  - Higher dependence on short term markets
    - liquidity
  - Higher exposure to balancing
    - Penal/volatile prices
  - Limited ability to avoid imbalance



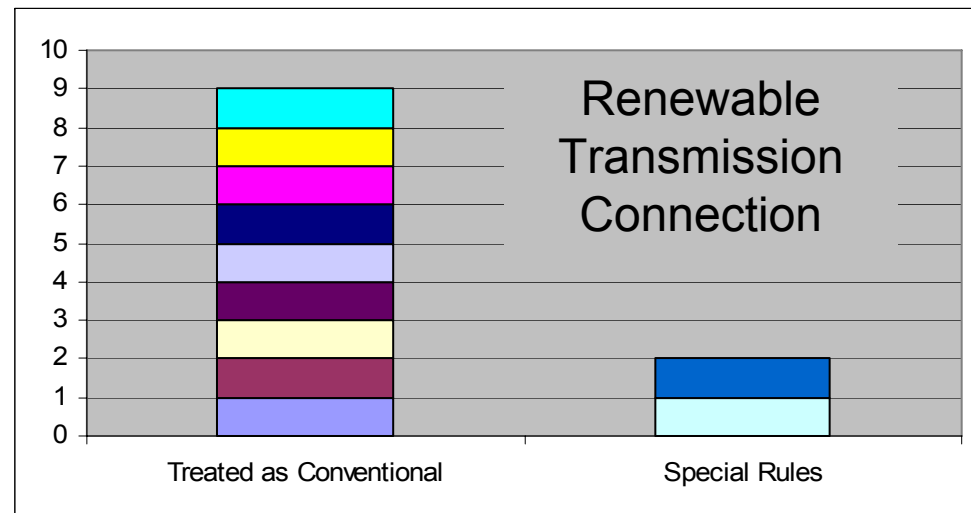
# Transmission Access

- Range of approaches to network reinforcement & charges
  - GB
    - Shallow connection
    - Locational transmission charging
- Issues for Renewables & charges
  - Network reinforcement
    - Site where there is resource
      - More reinforcement?
    - Renewables have intermittent use of transmission system



# Renewable Treatment

- Transmission treatment of renewables
  - Primarily same treatment as conventional generation
    - Model followed in GB
  - Contrasts with different market treatment of renewables in many countries
- Progressing renewable generation capacity
  - Key driver for proposed changes in GB transmission arrangements



# Transmission Development

- Key question for access
  - Capacity development
    - Build capacity for peak demand
      - How much capacity is required
      - Security criteria applied
    - Long term investment
      - Market signals or central planning
  - Rules for access provision
    - Reinforce and connect
    - Connect and manage
  - Firm or non-firm access
    - How do you pay for access
    - Short term constraint costs
      - Markets, targeted or socialised costs

# Barriers to Entry

- Differences between renewables & conventional plant
  - Variable output
    - Greater exposure to short term power & access markets, and balancing costs
  - Lower load factors/smaller projects
    - Complex rules & market costs
    - Proportionate cost targeting
  - Transmission Requirements
    - Access: Lower load factors & intermittent use
    - Planning: Transmission development & SoS Standards
  - Technical
    - Different capabilities to provide system services
- How do we treat the differences?
  - Integrated or separate approach for renewables?
  - What can we learn from power markets?

# Conclusions

- Define our objectives
  - Targeted Renewable Deployment
  - Minimising Market Distortions
- Economically Efficient Markets and Networks
  - Which elements of design are necessary for efficient operation?
  - What elements are necessary for integration of renewables?
    - Non-discriminatory treatment for all generation technologies?
  - What level of change could be justified?



# Thank You

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